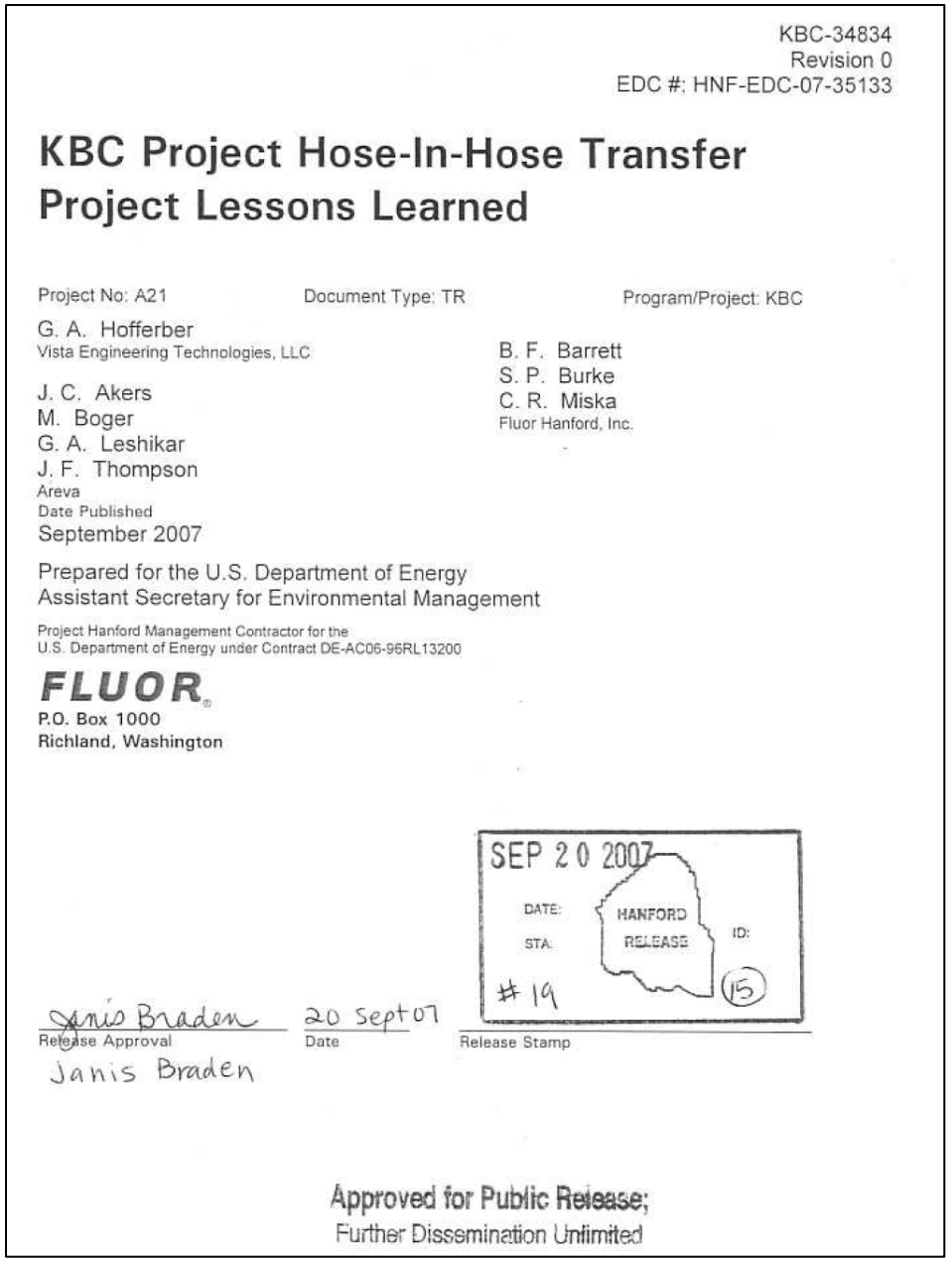
- ~27 m3 of settled sludge transferred successfully from the fuel storage basin at the KE Reactor in preparation for D&D
- System/Equipment Problems caused delays in project execution
- Project Lessons Learned were compiled to relate the nature of the problems and how the problems were overcome



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KBC Project Hose-In-Hose Transfer Project Lessons Learned

Project No: A21 Document Type: TR Program/Project: KBC

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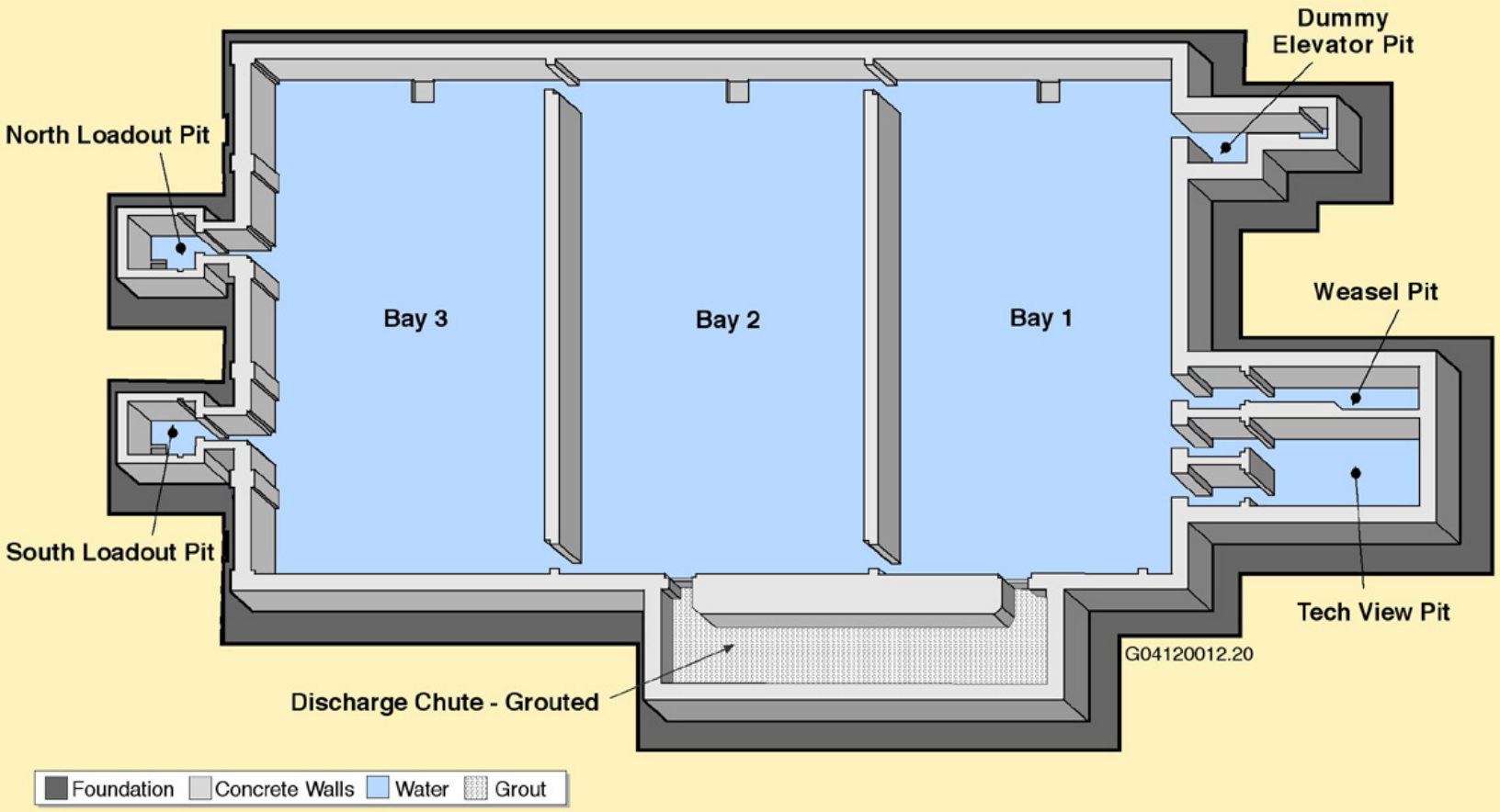
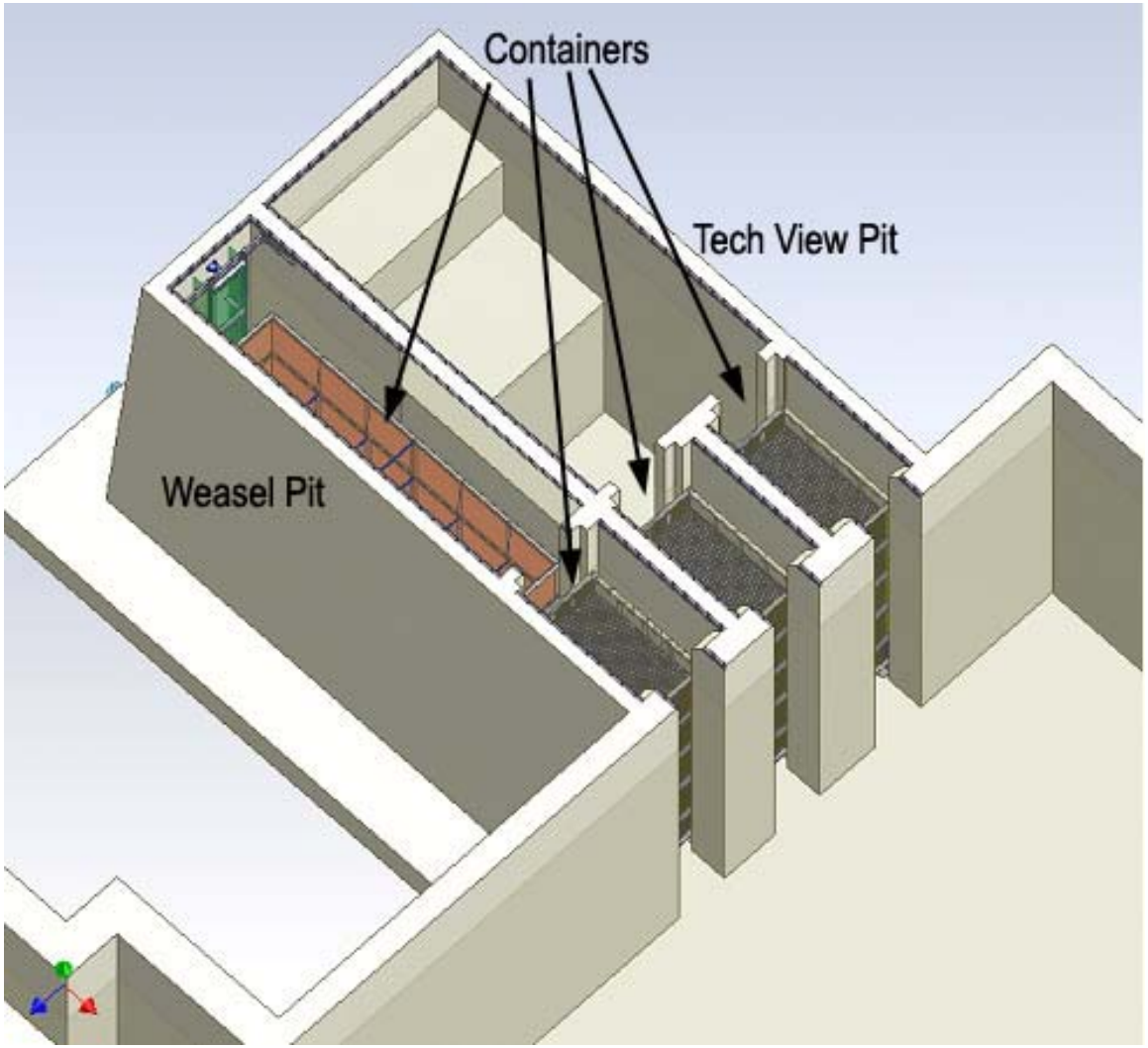
video

Schematic Overview of K East Storage Basin



Containers in KE



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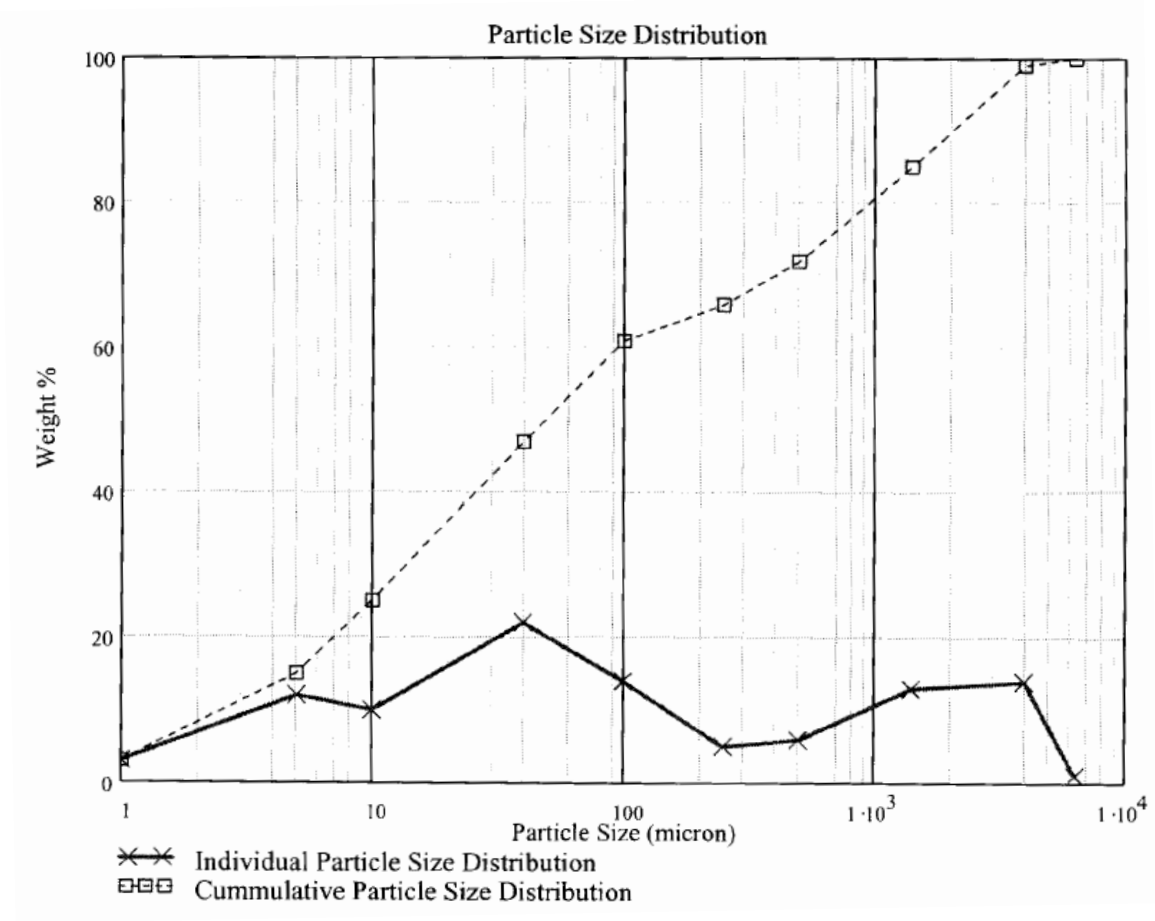
Sludge Composition

- Products of Fuel Corrosion during storage
  - Uranium Oxides
  - Uranium Metal pieces
  - Sand (blown in)
  - Spall from Concrete Basin Walls
- Insoluble
- Particle size distribution: < ¼”



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- Target slurry concentration ~2%weight
- Target system flow rate 64 gpm / 15 ft/sec
    - Driven by 1/4” diameter sG 19 particle
- Nominal Transfer hose ID = 1.25”
- Bottom Suction from KE container
- Dilution Control Automatic based upon solids % metering

- 7 centrifugal pumps in series – VFD Controlled (independently)
    - Suction Pump – Underwater in KE Basin
    - First Booster – Underwater in KE Basin
    - Four Above Ground Booster Pumps in Containment
    - Small Booster – Underwater in KW Basin
- Double Mechanical Seal w/ pressurized barrier fluid
- Installed Spare Pump in each station

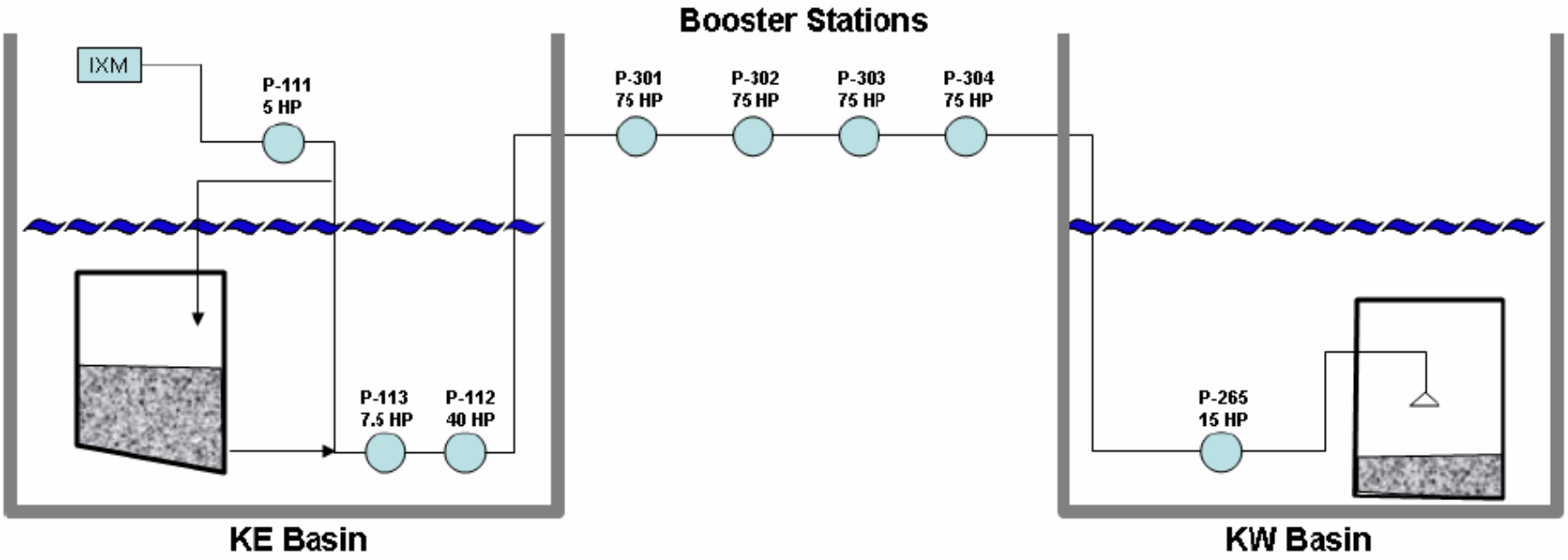

Figure 2-1 Simplified diagram of the HIH system

Testing

- Testing for slurry critical velocity and wear rates of hoses/fittings (Simulants)
- Sub-scale testing for centrifugal pump wear (Simulants)
- Full-scale Retrieval testing (Simulants)
- Integrated test of 4 Booster Stations (water only)
- Full-scale System Acceptance testing (water only)

Then… System Operation Begins

		SAT/SUN	MON	TUE	WED	THU	FRI	Percent Complete
Oct	14	off	OPERATIONS START CON-101	CON-101	FOCUS Day	Control Valve Slipping		4%
	21	off	<<<<<<<<<	<<<<<<<<<	FPSR DRY RUNS	>>>>>>>>>	>>>>>>>>>	4%
	28	off	<<<<<<<<<	<<<< FPSR Readiness Assessment >>>>			>>>>>>>>>	4%
Nov	4	off	P-265 Electrical Relay Problem		CON-101	Seal Pressure/Level Low - Re-seat		4%
	11	CON-101	CON-101	Indications of CON-101 plugging at tank outlet			FPSR	6%
	18	CON-102	CON-102	Conduit Nut found/ cleared in P-113	FPSR	Holiday		6%
	25	Additional blockage indicated - Back flush lines/pumps in KE - Found compression sleeve in P-113 discharge spool						6%
Dec	2	Install coarse In-line strainer	CON-102	Seal Pressure/ Level Low	CON-102	Recover from CON-102 Blockage		8%
	9	New coarse In-line strainer	CON-102	Difficulty with CON-102 retrieval. Attempted flushing.		Modified Dilution Strategy (secondary)		9%
	16	off	CON-102	CON-102	Resolved Locked Rotor at P-113		NCO training	10%
	23	off	Holiday		KW Crane work	Attempted Insertion of alternate coarse strainer		10%
	30	off	Holiday	CON-102	CON-102	Seal Pressure/ Level Low		16%
Jan	6	off	CON-102	CON-102	Resolved Locked Rotor at P-113	CON-102 First sign of noise (vibe) from P-302		19%
	13	Troubleshooting of P-302 vibration Aligned for use of P-332 (spare pump in booster station 2) Installed strainers in KE between P-113 and P-112						19%
	20							
	27	Disassemble P-302 spools Borescope investigation Aligned for P-331,333 / Installed Vibration transducers on pumps						19%
Feb	3							
	10							
	17	off	* Lowered Dilution Lance * Short in BS2 pump	CON-102	Establish Vibe limits for pump operation		CON-102	20%
	24	CON-102	CON-102	First indication of P-112 leak	Use air to find P-112 leak	Replace P-112		22%
Mar	3	Replace P-112		CON-102	CON-102	Realign for CON-101		25%
	10	CON-101	CON-101	CON-101	CON-101 dP issues with strainers	CON-101 First P-265 locked rotor	off	36%
	17	off	CON-101	CON-101	CON-101	P-265 unable be restarted	CON-101 P-265 bypassed	39%
	24	Gas bottle rack installed at booster stations	Line up to CON-104	CON-104	CON-104	CON-104	off	59%
Apr	31	off	CON-104	CON-104	Found second hole in P-112	UT for booster pump wear		68%
	7	Install new P-112	no HIH		CON-104	CON-104	off	74%
	14	CON-104	CON-104 video and sparging	CON-104	Line up to CON-103	CON-103	Moved coarse strainer	82%
	21	Video CON-104	CON-103	CON-103	CON-103	CON-103	FOCUS DAY	89%
	28	off	CON-103	Line up to CON-104	CON-104	CON-104	off	90%
May	5	off	CON-104	FTS Preps	CON-104	Realign to KW CON 240	off	92%
	12	off	FTS Load	Install Claw strainer in CON-101	CON-101	CON-101	Video CON-101 and CON-102	94%
	19	Video CON-102	CON-101	Line up and transfer CON-102	CON-102	Line up and transfer CON-104	off	97%
	26	Video CON-102	Solids Meter Cable Broken	CON-104	CON-104	CON-104	off	100%

Legend		
Days not available to HIH Operations	HIH System Operated	HIH Maintenance, Repair, Preparation

Figure 2-2 Hose-In-Hose Operations Timeline

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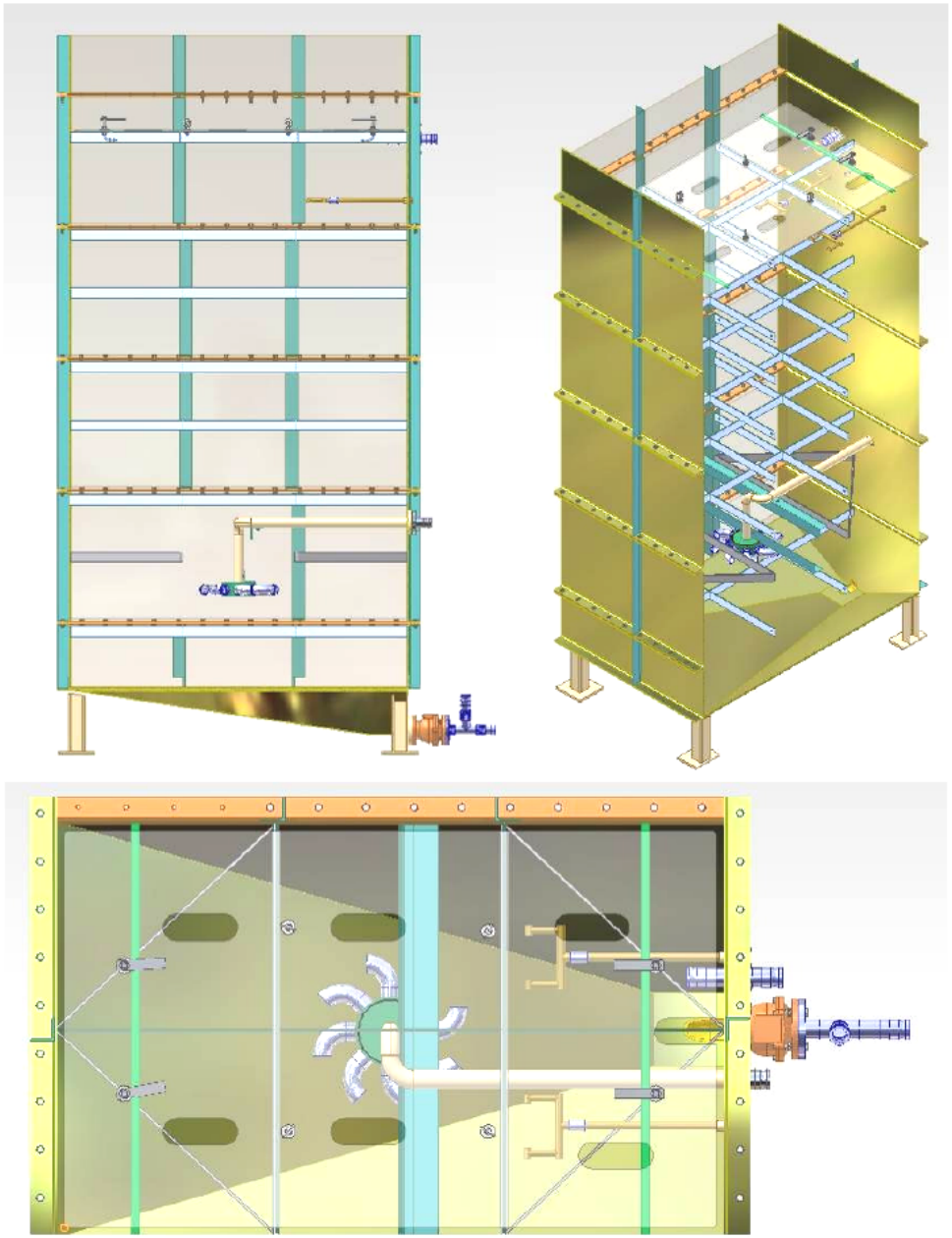

Figure 3-25 Side, Top, and Isometric Views of a Typical KE Container

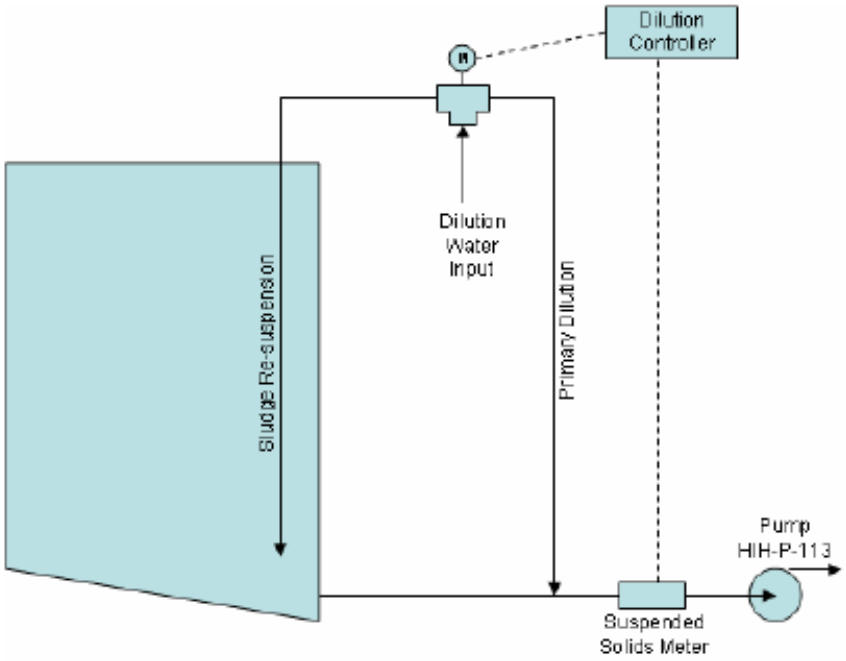

Figure 3-11 System Configuration Before and After Addition of In-line Coarse Strainer

- Construction Changes approved that moves dilution point further away from container (ease of operations issue)
- Foreign Material Inhibits suction line and fouls suction pump
- System trips due to insufficient suction pressure

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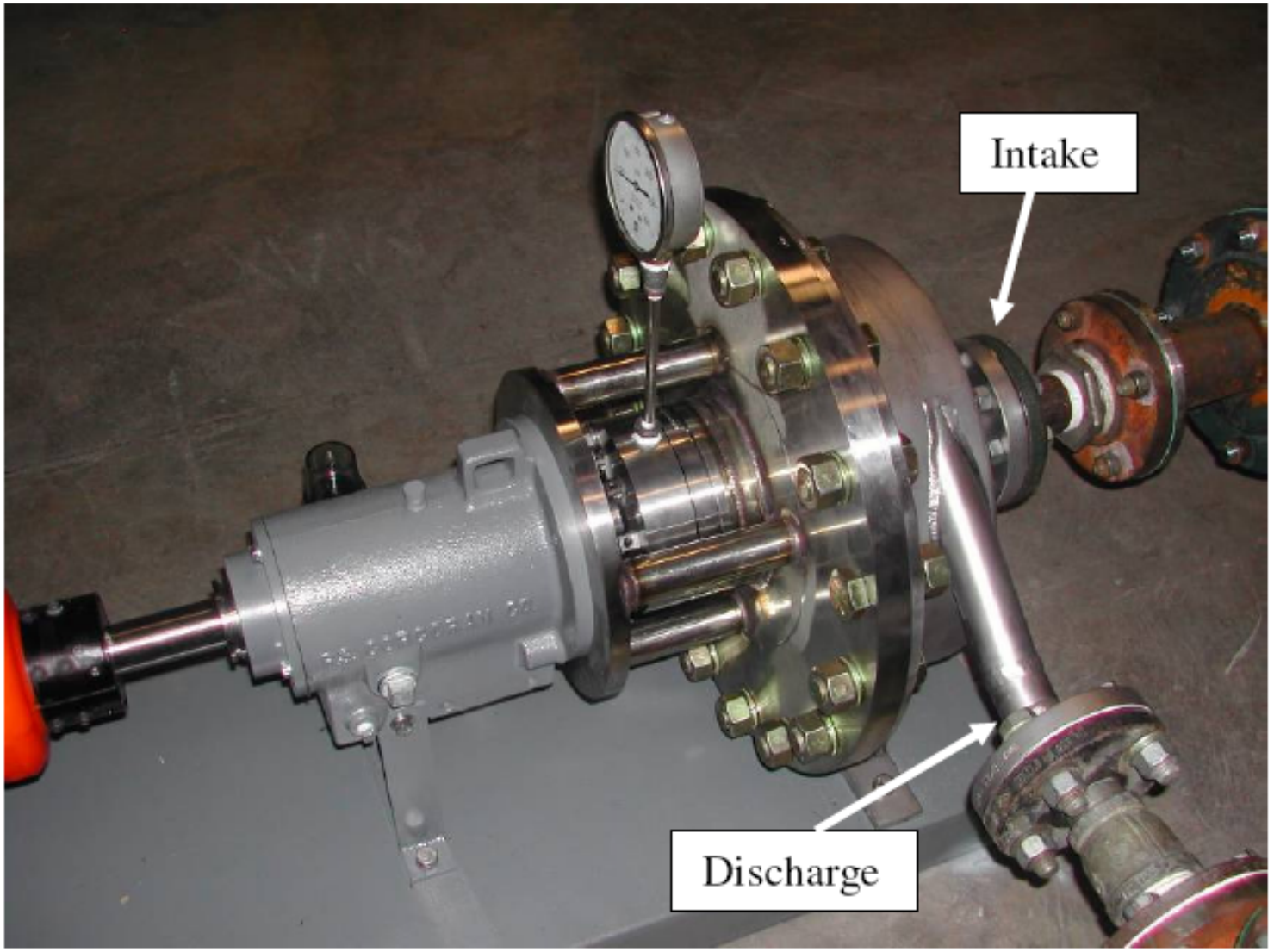


Figure 3-14 HIH Booster Pump

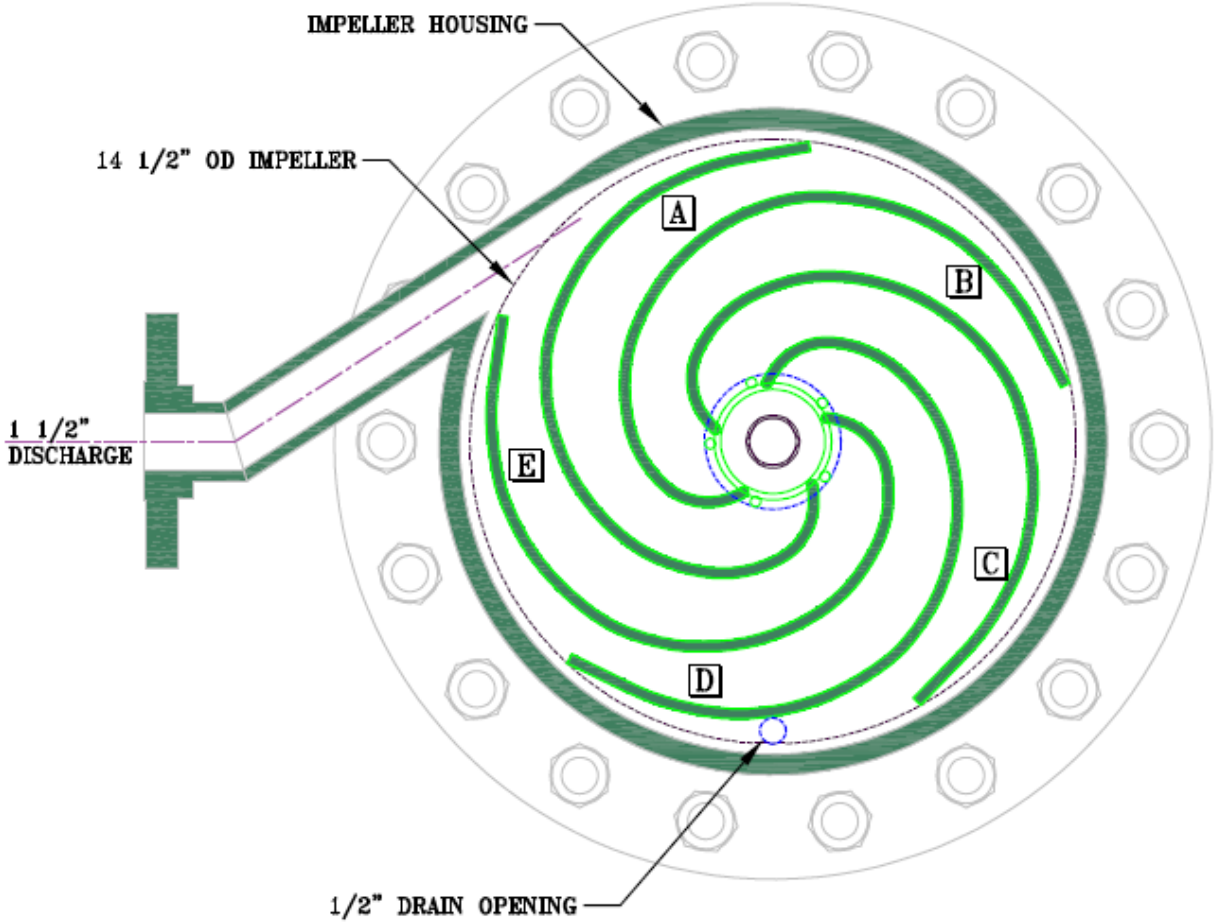


Figure 3-15 Map of R.W. Corcoran Impeller

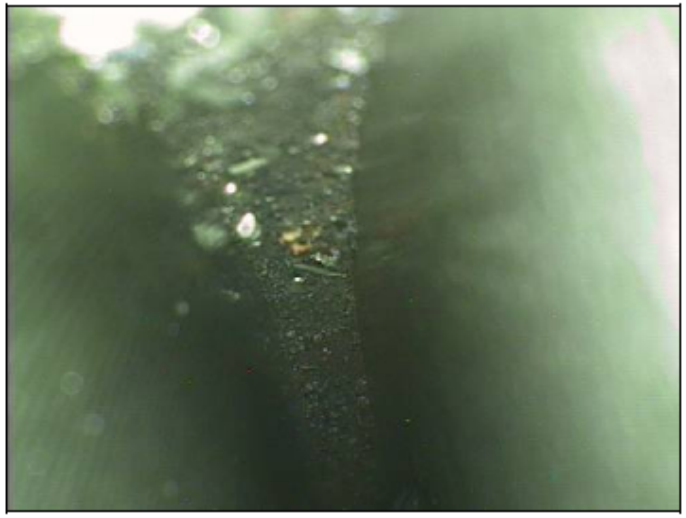


Figure 3-18 Impeller Cavity "A"

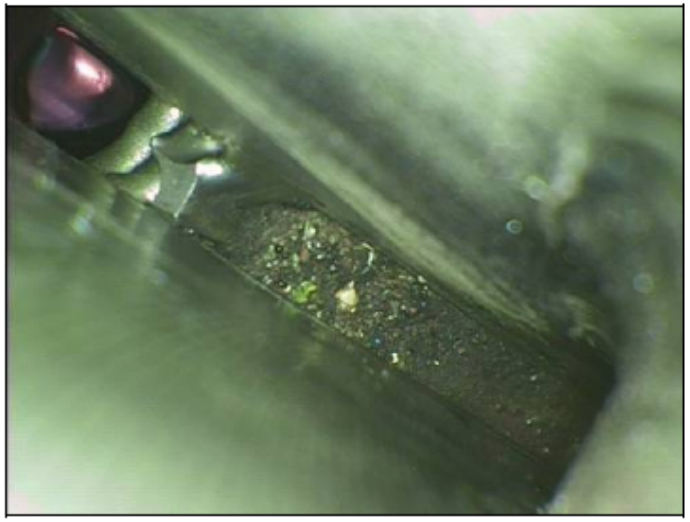


Figure 3-19 Impeller Cavity "E"

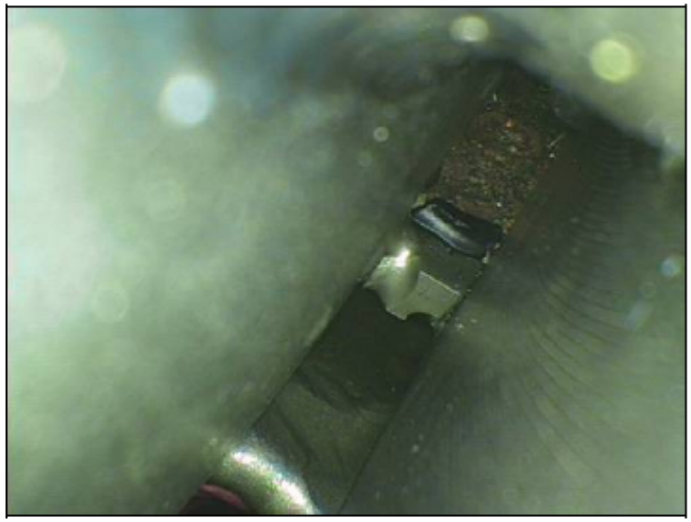


Figure 3-20 Impeller Cavity "C"

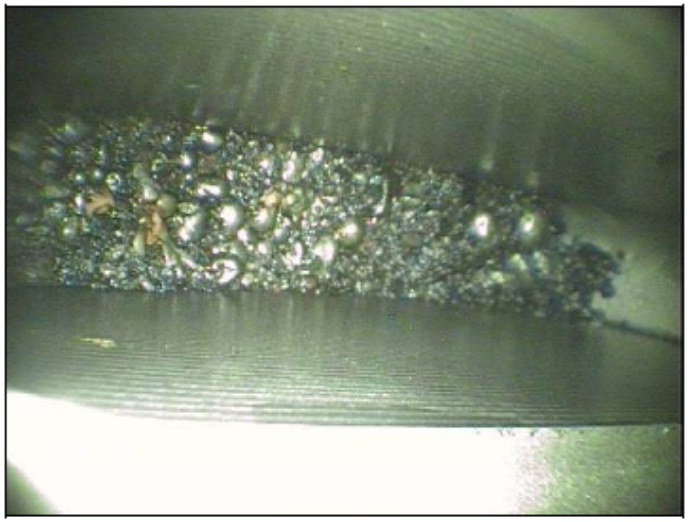


Figure 3-21 View From Impellor Eye

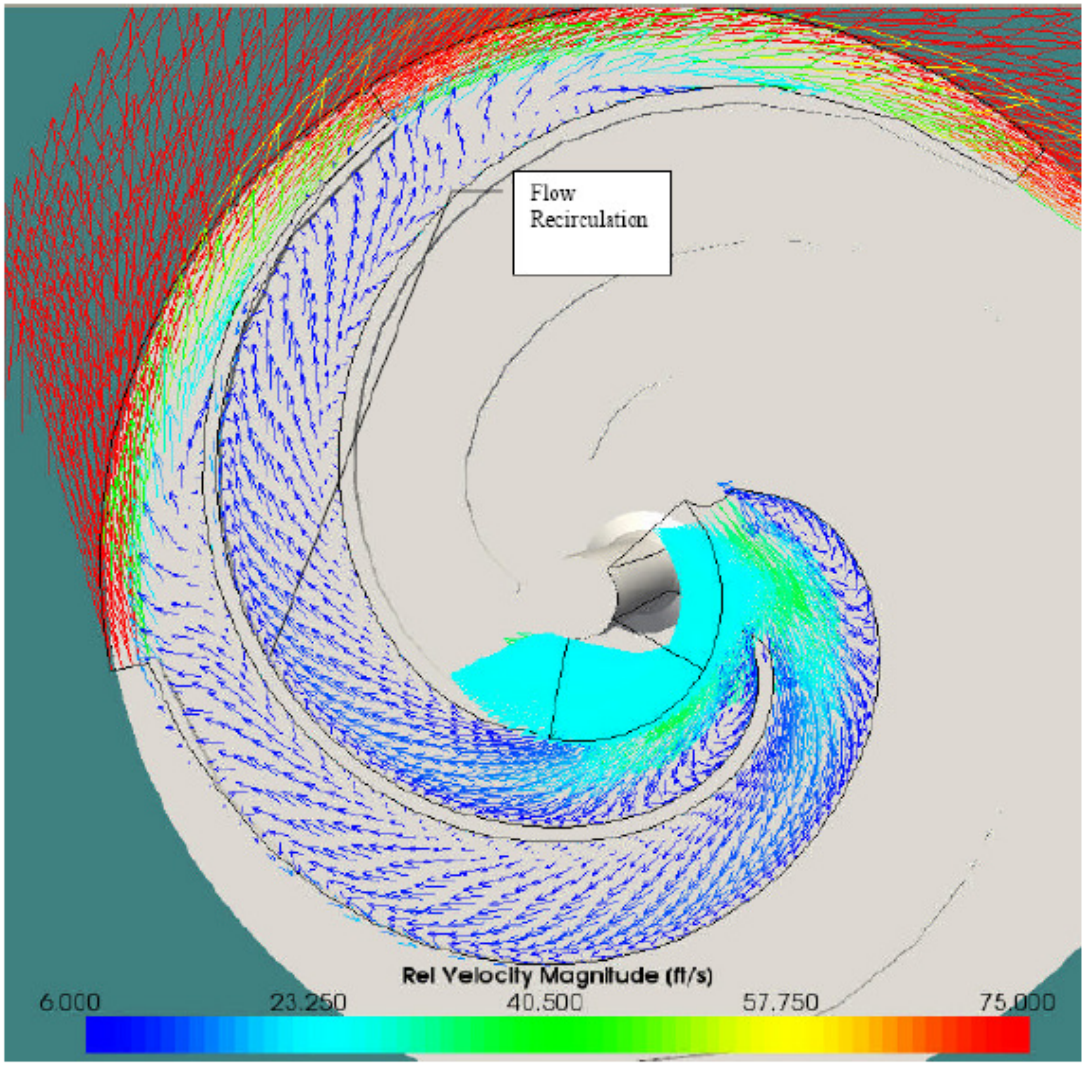
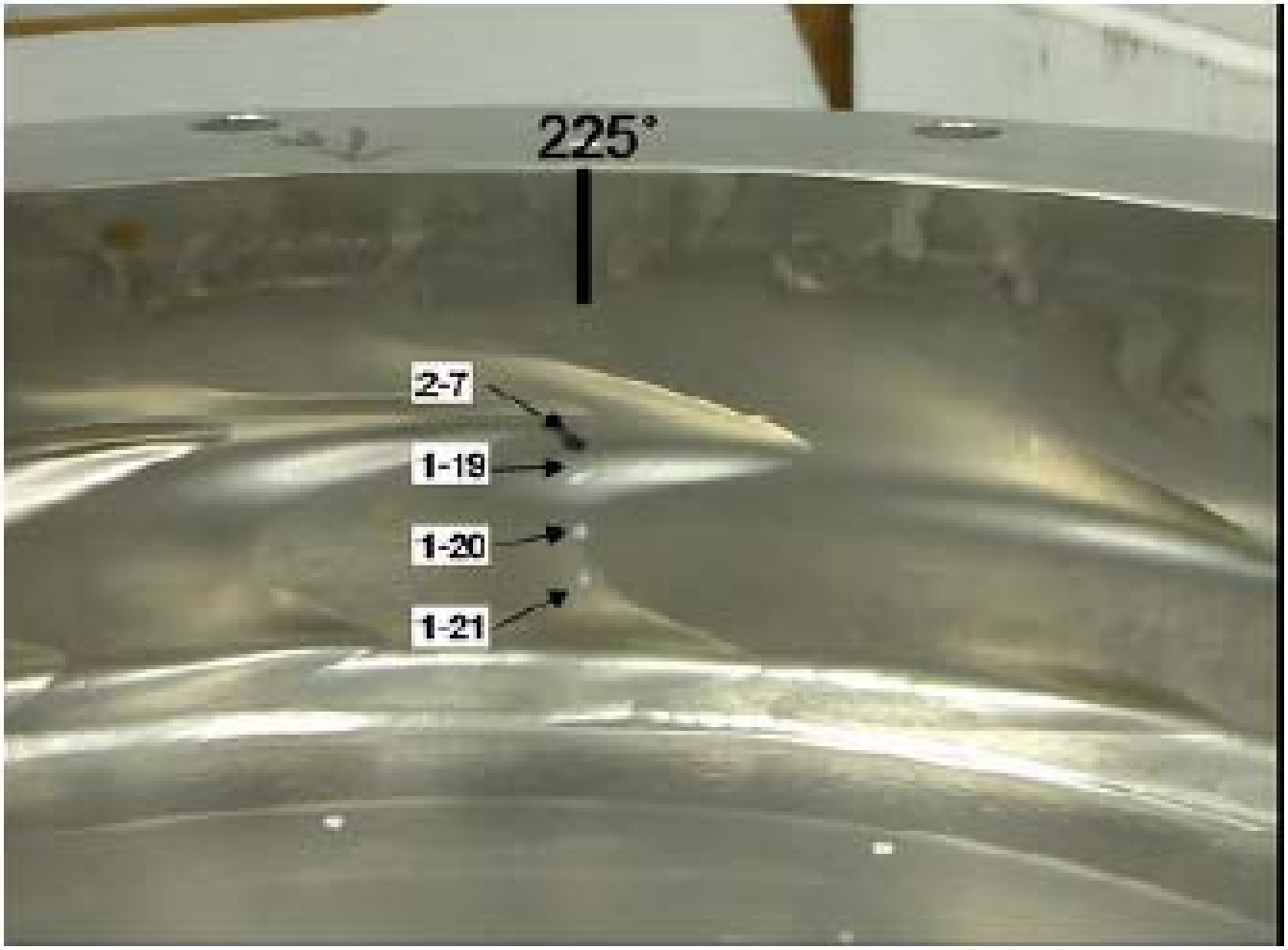


Figure 3-24 CFD-generated Relative Velocity Vector Diagram


225°
2-7
1-19
1-20
1-21

Test Results Drove Requirement for Monitoring of wear using UT thickness sensors fixed to pump and read remotely

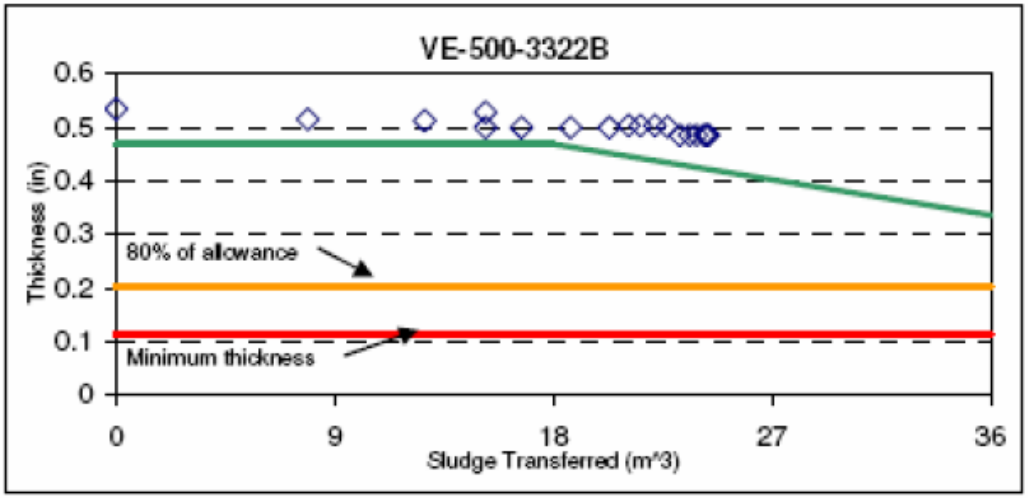


Figure 3-3 Wear at One Location on HIH-P-332

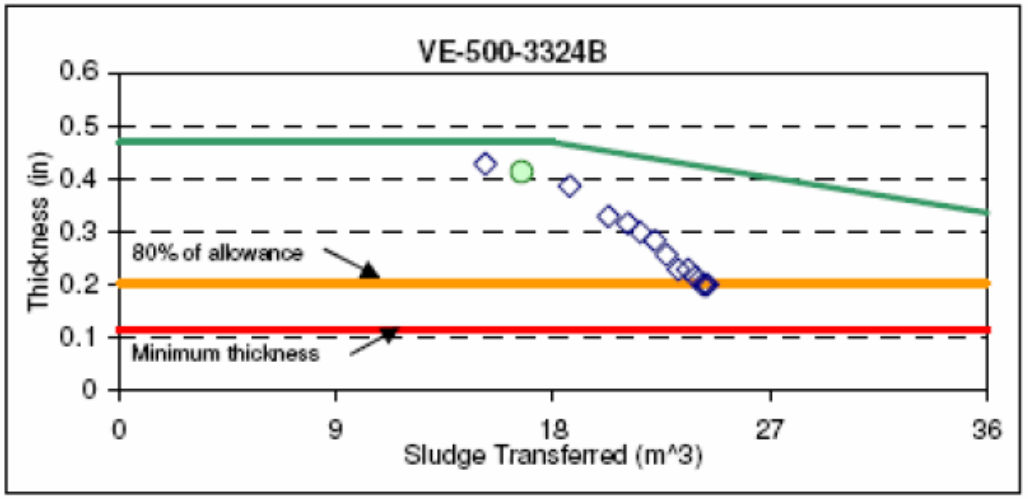


Figure 3-4 Worst Case Wear Location on HIH-P-332

Underwater Booster Pump experienced multiple wear failures

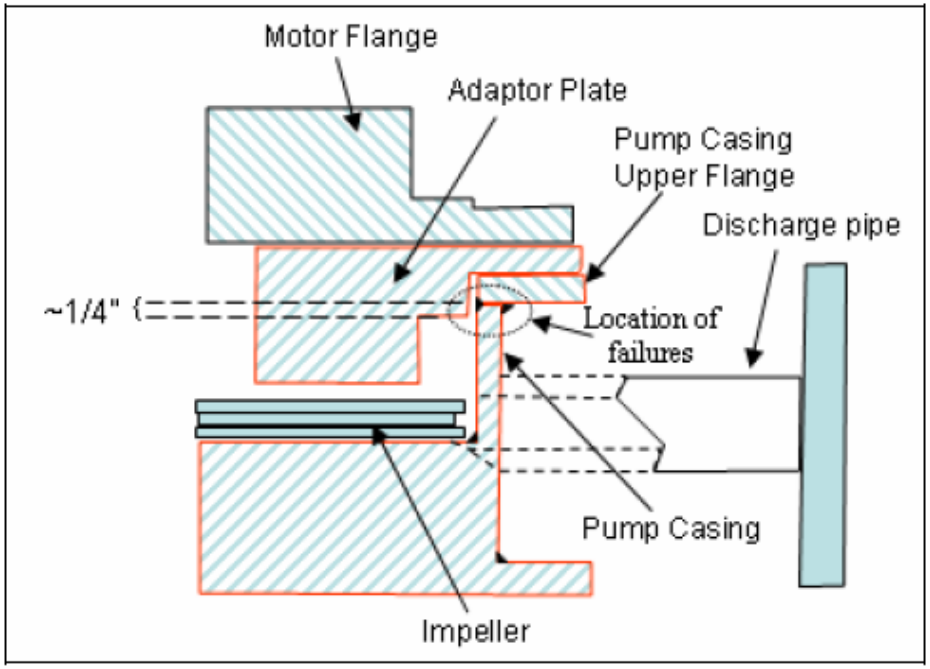


Figure 3-6 HIH-P-112 Cut-away View

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Future K-Basin sludge handling activities

- Completed Sludge Vacuuming in the K WEST basin as well
- KE and KW floor and Pit Sludge is containerized in KW
- Additional streams held in water treatment components in KW
- Sludge Treatment Project is in development to retrieve and treat the containerized sludge streams for disposal
- KE is being de-watered and prepared for D&D